Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Revision of Part 22 and Part 90 of the Commission's Rules to Facilitate Future Development of Paging Systems	)	WT Docket No. 96-18
	)	
	)	DOCKET FILE COPY ORIGINAL
Implementation of Section 309(j) of the Communications Act -- Competitive Bidding	)	PP Docket No. 93-253

To: The Commission

Comments of Comp Comm, Inc.
on the Commission's
Notice of Proposed Rule Making

Comp Comm, Inc. hereby respectfully submits comments in response to the above captioned Notice of Proposed Rule Making (NPRM) released February 9, 1996.

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Summary

Comp Comm, Inc. hereby respectfully submits comments and requests clarification in response to the above captioned Notice of Proposed Rule Making (NPRM) released February 9, 1996. Upon close inspection of the technical issues proposed in the NPRM, Comp Comm presents comments on the formulas proposed for 929 MHz and 931 MHz paging service and interference contour distances. In addition, comments are presented on the issue of the proposed geographical license area boundaries. As detailed later in the discussion, Comp Comm identifies potential problems in the NPRM, and offers an alternative to meet the interests of the public, industry and Commission.

The following discussion first comments upon the formulas proposed in the NPRM. Comp Comm applauds the Commission for its attempt to create formulas which predict signal propagation for 929 MHz and 931 MHz paging service, and accepts the Commission's invitation to comment upon the suitability of the formulas. The NPRM formulas for paging in the 929-931 MHz band were derived from a basic assumption of reliable service signal strength, although the NPRM fails to clarify any technical foundation supporting this assumption. It is the Commission's position to apply equivalent regulations to similar services. Comp Comm proposes that by applying similar logic used in the lower frequency bands, a

more realistic value is calculated for reliable service signal strength. A more reasonable signal level assumption can be derived from the Carey Report using the same method as used for the lower paging frequency bands. This signal strength is applied to the Okumura curves and two new formulas are proposed in the discussion.

Second, the Commission requested comment on the most suitable geographical license area boundaries. The NPRM proposes to use the major trading area (MTA) boundaries to define the boundaries of area paging licenses. The issue of protection at these boundaries should be addressed before implementation of the NPRM's proposals. As shown in the discussion, areas of no service due to signal degradation from an interfering signal, or dead zones, will occur at the boundaries between co-channel systems. Comp Comm requests clarification, and offers suggestions, to minimize potential dead zones.

Discussion

I. The proposed formulas for the higher frequency paging bands (929-930, 931-932 MHz) should be redefined.

A. The Commission's primary assumption of a 47 dBμV/m median field strength as the basis of the service area formula lacks foundation.

Comp Comm applauds the Commission for its attempt to create formulas which predict signal propagation for 929 MHz and 931 MHz paging service, and accepts the Commission's invitation to comment upon the suitability of the formulas. The Commission has stated a goal of standardizing the method of signal strength determination across the frequency bands and has raised the idea of using formulas for the 929 and 931 MHz paging operations to facilitate this goal. The idea is appealing, but the required signal strength assumptions are flawed. The proposed formulas work well under the assumption that a facility operating in this frequency band will give reliable service at 20 miles if the height and power are set at 1000 feet and 1000 watts, respectively. There is no technical basis for this assumption. Comp Comm proposes to demonstrate that a more reasonable signal level assumption can be derived from the Carey Report, and proposes the same method be used to determine reliable signal strengths for the other bands. This signal strength

can then be used in an equation which will better approximate the Okumura curves.

The service area formula proposed by the NPRM arbitrarily defines 47 dBμV/m as the median field strength for reliable service. With HAAT and ERP at 1000 ft and 1000 watts, respectively, the Carey curve for median field strength, F(50,50), reads 47 dBμV/m as the required signal strength at a distance of 20 miles. The Okumura curves also show 20 miles service at 47 dBμV/m for a similar facility. However, there is no evidence to support a 47 dBμV/m signal is required for service at 90% reliability. By applying similar logic used in the lower frequency bands, a different value is calculated for reliable service signal strength.

B. The determination of the median field strength for higher band CCP formulas should remain consistent with previous rulings.

The determination of the median field strength required to support formulas for 929 MHz and 931 MHz propagation should remain consistent with previous Commission rulings which determined formulas for lower CCP frequency bands.

The formulas currently used for lower band CCP as described in C.F.R. 47 § 22 were derived from the Carey Report (FCC Report No. R-6406). Prior to the lower band CCP formulas, contour distances were read directly from the Carey curves, and the formulas were later based upon these

curves. The curves give a statistical propagation distance for a range of signal strengths given height above average terrain (HAAT) and effective radiated power (ERP), i.e., the curves show signal strength vs. distance. The signal strength required for reliable service was determined for the lower frequency bands, and then applied to the curve to find the distances to the reliable service contour. In an effort to alleviate the complexity and ambiguity of using the curves, the Commission derived formulas designed to approximate the Carey curves based upon reliable service signal strengths, e.g., the formula used to determine service area boundary (SAB) distances for the cellular radio service is based upon a 32 dBμV/m service contour.[1]

The signal strength value used to determine the reliable service contour is calculated for the lower bands from the Carey Report as follows:

$$A = 105 + 10\log P_r + 20\log f_{MHz} \qquad \text{eq. 1}$$

where A is field strength corresponding to the receiver threshold in dBμV/m, P_r is the receiver input power in watts, and f is frequency in MHz. The Carey Report assumes that the logarithm of the field strength follows a normal distribution. Accordingly, the probability P for receiving a signal with a mean (median) field strength μ is given by

$$P = \frac{1}{\sigma\sqrt{2\pi}} \int_A^{\infty} e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2} dx \qquad \text{eq. 2}$$

[1] C.F.R. 47 § 22.911

where A is defined above. Using the data and definitions in the Carey Report, $\sigma_{VHF} = 8.58 dB\mu$ and $\sigma_{UHF} = 10.92 dB\mu$; this corresponds to a correction factor of 11 dB and 14 dB, respectively, to go from the mean to the point of 90% reliability. In general, the receiver threshold is determined by either the receiver sensitivity or the noise floor associated with the frequency band under study. The 930 MHz frequency band has a very low noise floor and the receiver sensitivity can be used to determine the required signal strength for reliable service. Probability theory, as demonstrated in the Carey Report, uses this figure to determine the 50% value for reliable service. This is then corrected to a 90% value by utilizing the 14 dB correction factor calculated using $\sigma_{UHF} = 10.92 dB\mu$. For example, the median signal strength, μ, needed to calculate P = 0.90 with receiver sensitivity of 0.35 μV/m and frequency of 870 MHz is 32 dBμV/m. (This value comes from the determination of $A = 18 \text{dB}\mu\text{V/m}$ from the formula, and a 14 dB correction factor to move from 50% to 90% reliability.) This corresponds with the Commission's definition for reliable service in this frequency band.

Using equation 1 of these comments, and the assumptions outlined above, with a typical receiver sensitivity of 0.35 μV for a 931 MHz pager, the required field strength at the receiver is calculated to be 19.38 dBμV/m for a 50% reliability value. This value is corrected to the 90%

reliability value as outlined above to a 33.38 dBμV/m value (rounded to 33 dBμV/m) for reliable service.

In order to determine the required signal strength to the interference contour, the desired signal ratio must be determined from the following equation in the Carey Report:

$$Desired - to - Undesired - Ratio = 6 + (14^2 + 14^2 + T_U^2)^{1/2} \qquad \text{eq. 3}$$

where 6 is the acceptance ratio, and T_u is the time fading of the interfering signal. T_u is usually small and can be neglected. For 930 MHz, this gives a desired-to-undesired ratio of 25.8 dB, which corresponds to the value of 26 dB as determined by the Commission. Using this calculated value, the signal strength for the undesired signal must not exceed 7 dBμV/m.

In accordance with the Carey Report, the Commission's proposal to use a signal strength of 47 dBμV/m would compare to a 99% reliability. This value is not supported by the methods used to calculate reliable service area in other bands.

C. Comp Comm proposes formulas more descriptive of reliable service and interference for 929 MHz and 931 MHz paging.

As discussed above, the 929-931 MHz paging service contour formula should be based upon a median receive signal strength of 33 dBμV/m. The interference contour formula,

separated by desired-to-undesired signal ratio of 26 dB, should be based upon a signal strength of 7 dBμV/m. Comp Comm agrees with the Commission's proposal to adhere formulas to the Okumura 900 MHz propagation curves as opposed to the Carey propagation model. Based upon the above criteria, and refraining from employing an unduly complex format, we propose the following formulas be used to define contour distances for 929-931 MHz paging service:

$$d_{Service(km)} = 0.46 \times haat_m^{0.48} \times erp_w^{0.30}$$

$$d_{Interference(km)} = 4.75 \times haat_m^{0.36} \times erp_w^{0.18}$$

See Attachment A graphs which plot both the formulas and Okumura propagation for comparison. As shown, the error is minimized around ERP values near 1000 watts and HAAT values between 80 to 160 meters. This was intended since these values represent the operating parameters of typical 931 MHz facilities.

II. The Commission should define procedures to maximize coverage at the geographical area boundaries.

A. The Commission should clarify proposed rules to protect a licensee's geographical area from neighboring interference.

The NPRM suggest no procedures to provide protection at geographical area boundaries. The NPRM presents service and interference contour formulas designed to afford a 26 dB ratio protection to incumbents. No procedures were defined to maintain the desired-to-undesired signal ratio of 26 dB between co-channel systems residing within neighboring markets. The question arises - at what distance (or signal strength) can a site be from a geographical boundary? If the distance is defined by the service contour formula, the result will be interference to each system (see Figure 1). Conversely, by using the interference contour formula to define the distance to the boundary, the result is an unnecessarily large dead zone, or area of no service due to signal degradation from an interfering signal (see Figure 2). The objectives of designing operating parameters for sites within a geographical area include protecting the neighboring systems while maximizing reliable service area. Comp Comm proposes using the service formula at the boundary. At first, this would seem to cause excess

interference across the boundary. But as Figures 1 and 2 show, the dead zone is minimized at close proximity to the boundary despite degradation of service. Also, if the interference formula is used at the boundary, potential service area is sacrificed by affording too much protection.

Fig. 1 - Boundary protected by Service Formula

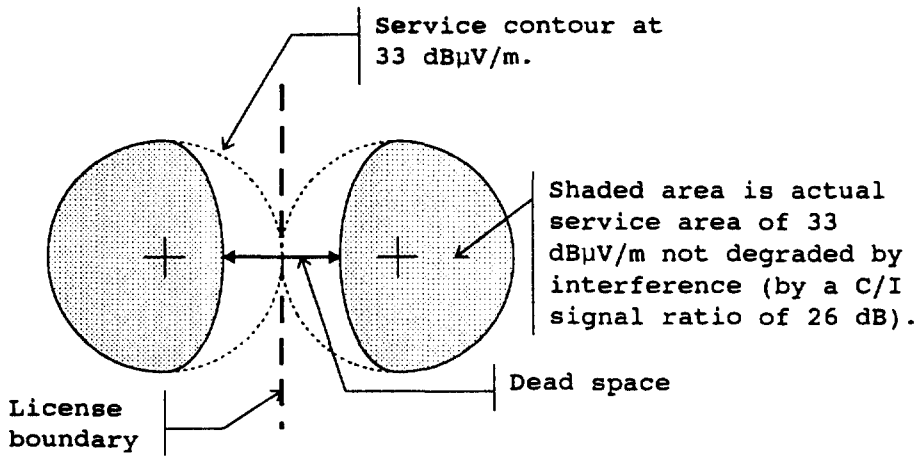
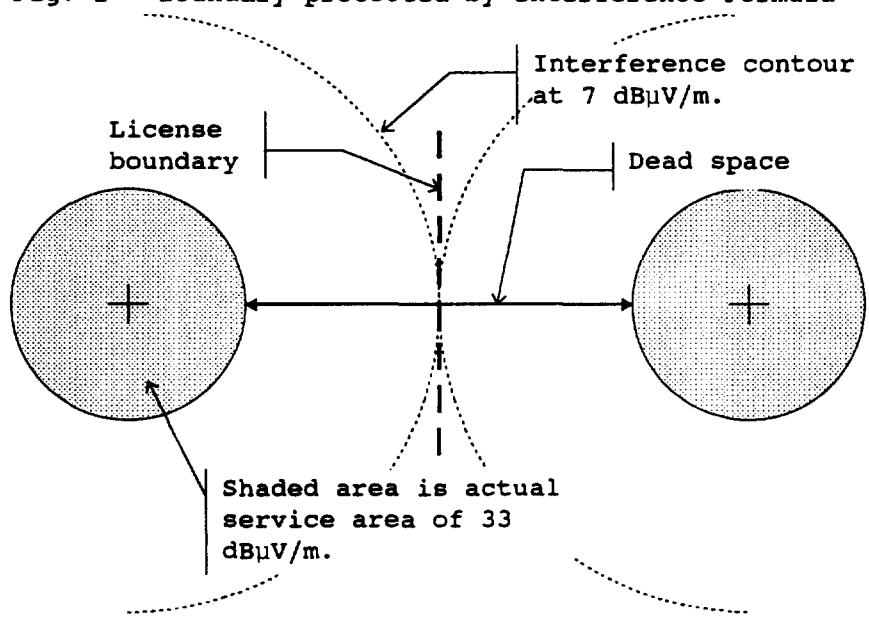


Fig. 2 - Boundary protected by Interference Formula



As shown in these figures, the dead zone is defined as the distance between the actual reliable service contours. For example, assume two facilities operating at 1000 watts omni ERP and 500' HAAT are mirrored on either side of a license boundary. The dead zone, when using the service formula as the separation distance, is approximately 38 km after the effects of interference; and when using the interference formula as the separation distance, the dead zone is approximately 72 km. (This example utilizes the Carey model with a reliable signal strength of 33 dBμV/m and a carrier-to-interference ratio of 26 dB.)

It is worth noting that the proximity and interference protection can be greatly improved using highly directional antennas. The example will still be valid, i.e., even when using directional antennas, a dead zone of no service will be minimized between two systems if the service formula is used instead of the interference formula.

B. Geographical area boundaries should be defined in such a manner as to avoid dead zones.

The NPRM suggests no procedures to provide protection at area boundaries. Unlike cellular radio architecture which provides "seamless" coverage by frequency re-use, the effects on paging service among competing co-channel signals creates wide area dead zones between systems (see previous

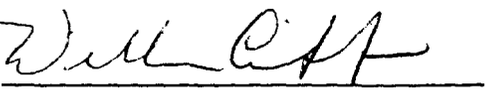
discussion in this reading). If boundaries are set along MTA perimeters *for all channels*, a corridor of no service will exist along these boundaries as shown in the previous section. This situation currently exists at boundaries of competing systems. A third system on a separate frequency can be used to service the border between the competing systems. This mechanism is blocked by the NPRM's proposal of implementing the same fixed boundaries for all channels. The Commission may wish to modify its proposal in consideration of the potential problems at system boundaries.

Conclusion

For the foregoing reasons, Comp Comm believes the Commission should reconsider the 47 dBμV/m field strength service area requirement and the formula derived from it. Also, clarification is required on how service at regional borders is to be handled by licensees.

Respectfully submitted,

Comp Comm, Inc.

By: 

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Attachment A

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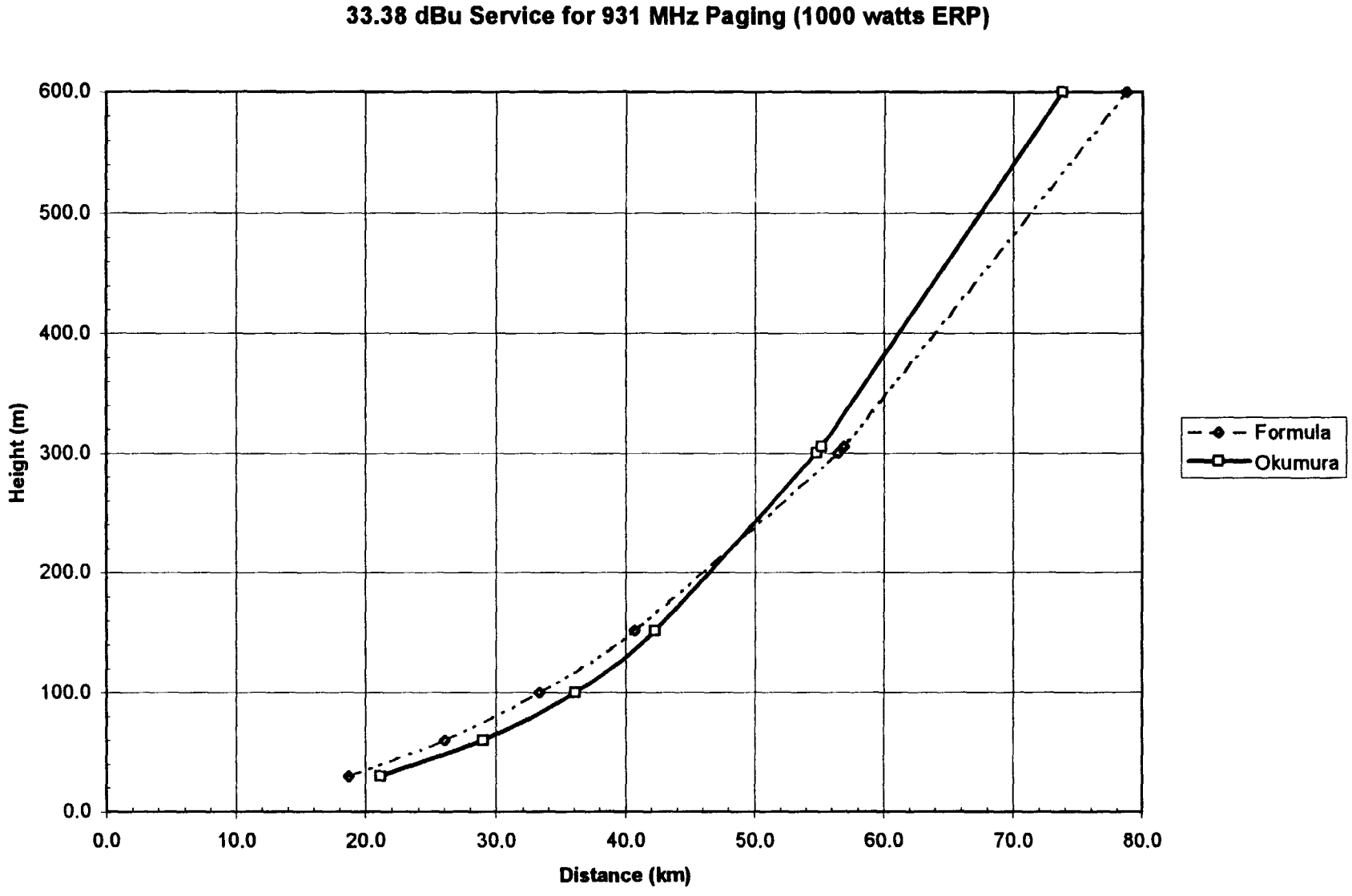

7.38 dBu Interference for 931 MHz Paging (1000 watts ERP)